

LIS008285372B2

(12) United States Patent Sing

(10) Patent No.: US 8,285,372 B2 (45) Date of Patent: Oct. 9, 2012

(54) ALERTNESS/DROWSINESS AND COGNITIVE CAPACITY INDEX

(75) Inventor: **Helen C. Sing**, Takoma Park, MD (US)

(73) Assignee: The United States of America as represented by the Secretary of the

Army, Washington, DC (US)

(*) Notice: Subject to any disclaimer, the term of this

patent is extended or adjusted under 35

U.S.C. 154(b) by 894 days.

(21) Appl. No.: 12/339,864

(22) Filed: Dec. 19, 2008

(65) **Prior Publication Data**

US 2009/0149770 A1 Jun. 11, 2009

Related U.S. Application Data

- (63) Continuation-in-part of application No. PCT/US2007/014541, filed on Jun. 22, 2007.
- (60) Provisional application No. 60/823,172, filed on Aug. 22, 2006, provisional application No. 60/815,565, filed on Jun. 22, 2006.

(51)	Int. Cl.		
	A61B 5/04	(2006.01)	
(52)	HC CI		6

See application file for complete search history.

(56) References Cited

U.S. PATENT DOCUMENTS

5,230,346	A	7/1993	Leuchter et al.
5,259,390	A	11/1993	MacLean
5,320,109	A	6/1994	Chamoun et al.

	5,433,223	A	7/1995	Moore-Ede et al.	
	5,566,067	A	10/1996	Hobson et al.	
	5,568,127	A	10/1996	Bang	
	5,570,698	A	11/1996	Liang	
	5,585,785	A	12/1996	Gwin	
	5,595,488	A	1/1997	Gozlan	
	5,647,633	A	7/1997	Fukuoka	
	5,682,144	A	10/1997	Mannik	
	5,689,241	A	11/1997	Clarke, Sr. et al.	
	5,691,693	A	11/1997	Kithil	
	5,813,993	A *	9/1998	Kaplan et al	600/544
0	1/0056225	A1*	12/2001	DeVito	600/300
0	2/0183644	A1*	12/2002	Levendowski et al	600/544

OTHER PUBLICATIONS

Sing, et al. "High Freuqnecy EEG as a Measure of Cognitive Function Capacity: A Preliminary Report." Aviation, Space, and Envirionmenal Medicine. vol. 76, No. 7, Section III, Jul. 2005.* Kaplan, R.F. An Innovative EEG Based Approach to Drowsiness Detection. Department of Systems and Control Engineering. Case Western Reserve University.* Kaplan, R.F. An Innovative EEG Based Approach to Drowsiness

Kaplan, R.F. An Innovative EEG Based Approach to Drowsiness Detection. Department of Systems and Engineering. Case Western Reserve University. May 1996. pp. 1-242.*

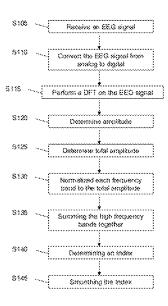
(Continued)

Primary Examiner — Patricia Mallari
Assistant Examiner — Tiffany Weston
(74) Attorney, Agent, or Firm — Elizabeth Arwine

(57) ABSTRACT

The invention includes a method and system for providing an Index representing the alertness state of an individual based at least in part on EEG signals obtained from the individual. In at least one embodiment, the EEG signals are divided into frequency bands and a total amplitude of the power is determined. Based on the proportion of the high frequency band compared to the proportion of the low frequency band, an Index is determined that is indicative of an individual's ability to perform a cognitive task.

28 Claims, 15 Drawing Sheets



600/545